What is claimed is:

1. An optical pickup apparatus for recording and/or reproducing information for an optical information recording medium having a plurality of information recording layers, comprising:

a light source to emit a light flux; and

a converging optical system to converge the light flux emitted from the light source onto each information recording layer of the plurality of information recording layers,

wherein the converging optical system converges a light flux having an image side-numerical aperture of 1.0 or more onto the each information recording layer so as to conduct recording and/or reproducing information for the each information recording layer.

2. The optical pickup apparatus of claim 1, wherein the converging optical system has a final optical element opposite to the optical information recording medium and a final optical surface of the final optical element comes in contact with a surface of the optical information recording medium.

3. The optical pickup apparatus of claim 1, wherein the converging optical system has a final optical element opposite to the optical information recording medium, a final optical surface of the final optical element locates close to the a surface of the optical information recording medium and a gap between the final optical surface and the surface of the optical information recording medium is smaller than a wavelength of the light source.

4. The optical pickup apparatus of claim 3, wherein the gap is not larger than (1/4) of the wavelength of the light source.

5. The optical pickup apparatus of claim 1, further comprising a plurality of converging optical systems as the converging optical system and each of the plurality of converging optical systems is used to conduct recording and/or reproducing information for an information recording layer different from that of others.

6. The optical pickup apparatus of claim 1, further comprising a selecting device to select an information recording layer from the plurality of information recording

layers, wherein recording and/or reproducing is conducted for the selected information recording layer.

7. The optical pickup apparatus of claim 6, wherein the converging optical system comprises at least two final optical elements used for conducting recording and/or reproducing for different information recording layers and wherein the selecting device selects one of the at least two final optical elements and the recording and/or reproducing is conducted for an information recording layer corresponding to the selected final optical element.

8. The optical pickup apparatus of claim 6, wherein the selecting device changes a wavelength of the light source in accordance with the information recording layer to be conducted recording and/or reproducing.

9. The optical pickup apparatus of claim 6, wherein at a light source side of the final optical element is provided an optical element to change a degree of divergence or a degree of convergence of an incident light flux on the final optical element in accordance with the information recording layer to be conducted recording and/or reproducing.

10. The optical pickup apparatus of claim 9, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and wherein at least one of the positive lens group and the negative lens group is a displaceable element.

11. The optical pickup apparatus of claim 10, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens group and the negative lens group is increased from the case that recording and/or reproducing is conducted for the second recording layer.

12. The optical pickup apparatus of claim 9, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens having a positive refracting power and a negative lens having a negative

refracting power and wherein at least one of the positive lens and the negative lens is a displaceable element.

13. The optical pickup apparatus of claim 12, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens and the negative lens is increased from the case that recording and/or reproducing is conducted for the second recording layer.

14. The optical pickup apparatus of claim 9, wherein the optical element to change a degree of divergence or a degree of convergence corrects a spherical aberration or an axial chromatic aberration interfering recording and/or reproducing information for the information recording layer to be conducted recording and/or reproducing.

15. The optical pickup apparatus of claim 14, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens group having a positive refracting power and a negative lens group

having a negative refracting power and satisfies the following formula:

$$\nu dP > \nu dN$$

where νdP is an average of Abbe's number of d-line of all positive lenses including the positive lens group, νdN is an average of Abbe's number of d-line of all negative lenses including the negative lens group.

16. The optical pickup apparatus of claim 15, wherein the νdP and the νdN satisfy the following formulas.

$$\nu dP > 55$$

$$\nu dN < 35$$

17. The optical pickup apparatus of claim 14, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and satisfies the following formula:

$$\nu dP > \nu dN$$

where νdP is an average of Abbe's number of d-line of all positive lenses including the positive lens, νdN is an

average of Abbe's number of d-line of all negative lenses including the negative lens.

18. The optical pickup apparatus of claim 17, wherein the vdP and the vdN satisfy the following formulas.

$$vdP > 55$$

$$vdN < 35$$

19. The optical pickup apparatus of claim 9, wherein the optical element to change a degree of divergence or a degree of convergence changes a distribution of refractive index.

20. The optical pickup apparatus of claim 1, wherein the converging optical system has an optical element having a aspherical surface.

21. The optical pickup apparatus of claim 1, wherein the converging optical system has an optical element having a diffractive surface provided with a ring-shaped diffractive structure.

22. The optical pickup apparatus of claim 1, wherein the converging optical system has an optical element made of a material having a specific gravity of 2.0 or less.

23. The optical pickup apparatus of claim 22, wherein the converging optical system has an optical element made of a plastic material.

24. The optical pickup apparatus of claim 22, wherein the converging optical system has an optical element made of a material having a saturation water absorption of 0.5% or less.

25. The optical pickup apparatus of claim 22, wherein the converging optical system has an optical element having an internal transmission rate of 85% or more at a portion having a thickness of 3 mm for the light flux having a oscillation wavelength of the light source.

26. The optical pickup apparatus of claim 1, wherein the converging optical system has at least two diaphragms to regulate an image side-numerical aperture for the plurality

of information recording layers of the optical information recording medium.

27. The optical pickup apparatus of claim 26, wherein at least one of the at least two diaphragms is located between a final optical element and the optical information recording medium. .

28. The optical pickup apparatus of claim 1, wherein the converging optical system comprises an optical element formed by etching.

29. An optical pickup apparatus for recording and/or reproducing information for an optical information recording medium having a plurality of information recording layers, comprising:

a light source to emit a light flux; and

a converging optical system to converge the light flux emitted from the light source onto each information recording layer of the plurality of information recording layers,

wherein the optical information recording medium comprises a transparent base board on an information recording layer positioned closest to the converging optical

system and the transparent base board has a thickness larger than a wavelength of the light source;

wherein the converging optical system comprises a final optical element opposite to the optical information recording medium with a gap smaller than the wavelength of the light source; and

wherein the converging optical system converges a light flux having an image side-numerical aperture of 1.0 or more onto the each information recording layer through the transparent base board so as to conduct recording and/or reproducing information for the each information recording layer.

30. The optical pickup apparatus of claim 29, wherein the gap is not larger than (1/4) of the wavelength of the light source.

31. The optical pickup apparatus of claim 29, further comprising a plurality of converging optical systems as the converging optical system and each of the plurality of converging optical systems is used to conduct recording and/or reproducing information for an information recording layer different from that of others.

32. The optical pickup apparatus of claim 29, further comprising a selecting device to select an information recording layer from the plurality of information recording layers, wherein recording and/or reproducing is conducted for the selected information recording layer.

33. The optical pickup apparatus of claim 32, wherein the converging optical system comprises at least two final optical elements used for conducting recording and/or reproducing for different information recording layers and wherein the selecting device selects one of the at least two final optical elements and the recording and/or reproducing is conducted for an information recording layer corresponding to the selected final optical element.

34. The optical pickup apparatus of claim 32, wherein the selecting device changes a wavelength of the light source in accordance with the information recording layer to be conducted recording and/or reproducing.

35. The optical pickup apparatus of claim 32, wherein at a light source side of the final optical element is provided an

optical element to change a degree of divergence or a degree of convergence of an incident light flux on the final optical element in accordance with the information recording layer to be conducted recording and/or reproducing.

36. The optical pickup apparatus of claim 35, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and wherein at least one of the positive lens group and the negative lens group is a displaceable element.

37. The optical pickup apparatus of claim 36, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens group and the negative lens group is increased from the case that recording and/or reproducing is conducted for the second recording layer.

38. The optical pickup apparatus of claim 35, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and wherein at least one of the positive lens and the negative lens is a displaceable element.

39. The optical pickup apparatus of claim 38, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens and the negative lens is increased from the case that recording and/or reproducing is conducted for the second recording layer.

40. The optical pickup apparatus of claim 35, wherein the optical element to change a degree of divergence or a degree of convergence corrects a spherical aberration or an axial chromatic aberration interfering recording and/or reproducing information for the information recording layer to be conducted recording and/or reproducing.

41. The optical pickup apparatus of claim 40, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and satisfies the following formula:

$$vdP > vdN$$

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens group, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens group.

42. The optical pickup apparatus of claim 41, wherein the vdP and the vdN satisfy the following formulas.

$$vdP > 55$$

$$vdN < 35$$

43. The optical pickup apparatus of claim 40, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens having a positive refracting power and a negative lens having a

negative refracting power and satisfies the following formula:

$$vdP > vdN$$

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens.

44. The optical pickup apparatus of claim 43, wherein the vdP and the vdN satisfy the following formulas.

$$vdP > 55$$

$$vdN < 35$$

45. The optical pickup apparatus of claim 35, wherein the optical element to change a degree of divergence or a degree of convergence changes a distribution of refractive index.

46. The optical pickup apparatus of claim 29, wherein the converging optical system has an optical element having a aspherical surface.

47. The optical pickup apparatus of claim 29, wherein the converging optical system has an optical element having a diffractive surface provided with a ring-shaped diffractive structure.

48. The optical pickup apparatus of claim 29, wherein the converging optical system has an optical element made of a material having a specific gravity of 2.0 or less.

49. The optical pickup apparatus of claim 48, wherein the converging optical system has an optical element made of a plastic material.

50. The optical pickup apparatus of claim 48, wherein the converging optical system has an optical element made of a material having a saturation water absorption of 0.5% or less.

51. The optical pickup apparatus of claim 48, wherein the converging optical system has an optical element having an internal transmission rate of 85% or more at a portion having a thickness of 3 mm for the light flux having a oscillation wavelength of the light source.

52. The optical pickup apparatus of claim 29, wherein the converging optical system has at least two diaphragms to regulate an image side-numerical aperture for the plurality of information recording layers of the optical information recording medium.

53. The optical pickup apparatus of claim 52, wherein at least one of the at least two diaphragms is located between a final optical element and the optical information recording medium.

54. The optical pickup apparatus of claim 29, wherein the converging optical system comprises an optical element formed by etching.

55. A converging optical system for use in an optical pickup apparatus having a light source to emit a light flux and for recording and/or reproducing information for an optical information recording medium having a plurality of information recording layers, comprising:

the converging optical system to converge the light flux emitted from the light source onto each information

recording layer of the plurality of information recording layers,

wherein the converging optical system converges a light flux having an image side-numerical aperture of 1.0 or more onto the each information recording layer so as to conduct recording and/or reproducing information for the each information recording layer.

56. The converging optical system of claim 55, wherein the converging optical system has a final optical element opposite to the optical information recording medium and a final optical surface of the final optical element comes in contact with the a surface of the optical information recording medium.

57. The converging optical system of claim 55, wherein the converging optical system has a final optical element opposite to the optical information recording medium, a final optical surface of the final optical element locates close to the a surface of the optical information recording medium and a gap between the final optical surface and the surface of the optical information recording medium is smaller than a wavelength of the light source.

58. The converging optical system of claim 57, wherein the gap is not larger than (1/4) of the wavelength of the light source.

59. The converging optical system of claim 55, further comprising a plurality of converging optical systems as the converging optical system and each of the plurality of converging optical systems is used to conduct recording and/or reproducing information for an information recording layer different from that of others.

60. The converging optical system of claim 55, further comprising a selecting device to select an information recording layer from the plurality of information recording layers, wherein recording and/or reproducing is conducted for the selected information recording layer.

61. The converging optical system of claim 60, wherein the converging optical system comprises at least two final optical elements used for conducting recording and/or reproducing for different information recording layers and wherein the selecting device selects one of the at least two

final optical elements and the recording and/or reproducing is conducted for an information recording layer corresponding to the selected final optical element.

62. The converging optical system of claim 60, wherein the selecting device changes a wavelength of the light source in accordance with the information recording layer to be conducted recording and/or reproducing.

63. The converging optical system of claim 60, wherein at a light source side of the final optical element is provided an optical element to change a degree of divergence or a degree of convergence of an incident light flux on the final optical element in accordance with the information recording layer to be conducted recording and/or reproducing.

64. The converging optical system of claim 63, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and wherein at least one of the positive lens group and the negative lens group is a displaceable element.

65. The converging optical system of claim 64, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens group and the negative lens group is increased from the case that recording and/or reproducing is conducted for the second recording layer.

66. The converging optical system of claim 63, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and wherein at least one of the positive lens and the negative lens is a displaceable element.

67. The converging optical system of claim 66, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens and the negative lens is increased

from the case that recording and/or reproducing is conducted for the second recording layer.

68. The converging optical system of claim 63, wherein the optical element to change a degree of divergence or a degree of convergence corrects a spherical aberration or an axial chromatic aberration interfering recording and/or reproducing information for the information recording layer to be conducted recording and/or reproducing.

69. The converging optical system of claim 68, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and satisfies the following formula:

$$\nu dP > \nu dN$$

where νdP is an average of Abbe's number of d-line of all positive lenses including the positive lens group, νdN is an average of Abbe's number of d-line of all negative lenses including the negative lens group.

70. The converging optical system of claim 69, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

71. The converging optical system of claim 68, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and satisfies the following formula:

vdP > vdN

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens.

72. The converging optical system of claim 71, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

73. The converging optical system of claim 63, wherein the optical element to change a degree of divergence or a degree of convergence changes a distribution of refractive index.

74. The converging optical system of claim 55, wherein the converging optical system has an optical element having a aspherical surface.

75. The converging optical system of claim 55, wherein the converging optical system has an optical element having a diffractive surface provided with a ring-shaped diffractive structure.

76. The converging optical system of claim 55, wherein the converging optical system has an optical element made of a material having a specific gravity of 2.0 or less.

77. The converging optical system of claim 76, wherein the converging optical system has an optical element made of a plastic material.

78. The converging optical system of claim 76, wherein the converging optical system has an optical element made of a

material having a saturation water absorption of 0.5% or less.

79. The converging optical system of claim 76, wherein the converging optical system has an optical element having an internal transmission rate of 85% or more at a portion having a thickness of 3 mm for the light flux having a oscillation wavelength of the light source.

80. The converging optical system of claim 55, wherein the converging optical system has at least two diaphragms to regulate an image side-numerical aperture for the plurality of information recording layers of the optical information recording medium.

81. The converging optical system of claim 80, wherein at least one of the at least two diaphragms is located between a final optical element and the optical information recording medium.

82. The converging optical system of claim 55, wherein the converging optical system comprises an optical element formed by etching.

83. A converging optical system for use in an optical pickup apparatus having a light source to emit a light flux and for recording and/or reproducing information for an optical information recording medium having a plurality of information recording layers, comprising:

the converging optical system to converge the light flux emitted from the light source onto each information recording layer of the plurality of information recording layers,

wherein the optical information recording medium comprises a transparent base board on an information recording layer positioned closest to the converging optical system and the transparent base board has a thickness larger than a wavelength of the light source;

wherein the converging optical system comprises a final optical element opposite to the optical information recording medium with a gap smaller than the wavelength of the light source; and

wherein the converging optical system converges a light flux having an image side-numerical aperture of 1.0 or more onto the each information recording layer through the transparent base board so as to conduct recording and/or

reproducing information for the each information recording layer.

84. The converging optical system of claim 83, wherein the gap is not larger than (1/4) of the wavelength of the light source.

85. The converging optical system of claim 83, further comprising a plurality of converging optical systems as the converging optical system and each of the plurality of converging optical systems is used to conduct recording and/or reproducing information for an information recording layer different from that of others.

86. The converging optical system of claim 83, further comprising a selecting device to select an information recording layer from the plurality of information recording layers, wherein recording and/or reproducing is conducted for the selected information recording layer.

87. The converging optical system of claim 86, wherein the converging optical system comprises at least two final optical elements used for conducting recording and/or

reproducing for different information recording layers and wherein the selecting device selects one of the at least two final optical elements and the recording and/or reproducing is conducted for an information recording layer corresponding to the selected final optical element.

88. The converging optical system of claim 86, wherein the selecting device changes a wavelength of the light source in accordance with the information recording layer to be conducted recording and/or reproducing.

89. The converging optical system of claim 86, wherein at a light source side of the final optical element is provided an optical element to change a degree of divergence or a degree of convergence of an incident light flux on the final optical element in accordance with the information recording layer to be conducted recording and/or reproducing.

90. The converging optical system of claim 89, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and wherein at least one of the

positive lens group and the negative lens group is a displaceable element.

91. The converging optical system of claim 90, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens group and the negative lens group is increased from the case that recording and/or reproducing is conducted for the second recording layer.

92. The converging optical system of claim 89, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and wherein at least one of the positive lens and the negative lens is a displaceable element.

93. The converging optical system of claim 92, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or

reproducing is conducted for the first recording layer, a gap between the positive lens and the negative lens is increased from the case that recording and/or reproducing is conducted for the second recording layer.

94. The converging optical system of claim 89, wherein the optical element to change a degree of divergence or a degree of convergence corrects a spherical aberration or an axial chromatic aberration interfering recording and/or reproducing information for the information recording layer to be conducted recording and/or reproducing.

95. The converging optical system of claim 94, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and satisfies the following formula:

$$\nu dP > \nu dN$$

where νdP is an average of Abbe's number of d-line of all positive lenses including the positive lens group, νdN is an

average of Abbe's number of d-line of all negative lenses including the negative lens group.

96. The converging optical system of claim 95, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

97. The converging optical system of claim 94, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and satisfies the following formula:

vdP > vdN

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens.

98. The converging optical system of claim 97, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

99. The converging optical system of claim 89, wherein the optical element to change a degree of divergence or a degree of convergence changes a distribution of refractive index.

100. The converging optical system of claim 83, wherein the converging optical system has an optical element having a aspherical surface.

101. The converging optical system of claim 83, wherein the converging optical system has an optical element having a diffractive surface provided with a ring-shaped diffractive structure.

102. The converging optical system of claim 83, wherein the converging optical system has an optical element made of a material having a specific gravity of 2.0 or less.

103. The converging optical system of claim 102, wherein the converging optical system has an optical element made of a plastic material.

104. The converging optical system of claim 102, wherein the converging optical system has an optical element made of a material having a saturation water absorption of 0.5% or less.

105. The converging optical system of claim 102, wherein the converging optical system has an optical element having an internal transmission rate of 85% or more at a portion having a thickness of 3 mm for the light flux having a oscillation wavelength of the light source.

106. The converging optical system of claim 83, wherein the converging optical system has at least two diaphragms to regulate an image side-numerical aperture for the plurality of information recording layers of the optical information recording medium.

107. The converging optical system of claim 106, wherein at least one of the at least two diaphragms is located between a

final optical element and the optical information recording medium.

108. The optical pickup apparatus of claim 83, wherein the converging optical system comprises an optical element formed by etching.

109. A method of recording and/or reproducing information for an optical information recording medium having a plurality of information recording layers with an optical pickup apparatus which comprises a light source to emit a light flux; and a converging optical system to converge the light flux emitted from the light source onto each information recording layer of the plurality of information recording layers, the method comprising:

conducting recording and/or reproducing information for the each information recording layer by converging a light flux having an image side-numerical aperture of 1.0 or more onto the each information recording layer.

110. The method of claim 109, wherein the converging optical system has a final optical element opposite to the optical information recording medium and a final optical surface of

the final optical element comes in contact with the a surface of the optical information recording medium.

111. The method of claim 109, wherein the converging optical system has a final optical element opposite to the optical information recording medium, a final optical surface of the final optical element locates close to the a surface of the optical information recording medium and a gap between the final optical surface and the surface of the optical information recording medium is smaller than a wavelength of the light source.

112. The method of claim 111, wherein the gap is not larger than (1/4) of the wavelength of the light source.

113. The method of claim 109, wherein the optical pickup apparatus further comprises a plurality of converging optical systems as the converging optical system and each of the plurality of converging optical systems is used to conduct recording and/or reproducing information for an information recording layer different from that of others.

114. The method of claim 109, wherein the optical pickup apparatus further comprises a selecting device to select an information recording layer from the plurality of information recording layers, wherein recording and/or reproducing is conducted for the selected information recording layer.

115. The method of claim 114, wherein the converging optical system comprises at least two final optical elements used for conducting recording and/or reproducing for different information recording layers and wherein the selecting device selects one of the at least two final optical elements and the recording and/or reproducing is conducted for an information recording layer corresponding to the selected final optical element.

116. The method of claim 114, wherein the selecting device changes a wavelength of the light source in accordance with the information recording layer to be conducted recording and/or reproducing.

117. The method of claim 114, wherein at a light source side of the final optical element is provided an optical element to change a degree of divergence or a degree of convergence

of an incident light flux on the final optical element in accordance with the information recording layer to be conducted recording and/or reproducing.

118. The method of claim 117, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and wherein at least one of the positive lens group and the negative lens group is a displaceable element.

119. The method of claim 118, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens group and the negative lens group is increased from the case that recording and/or reproducing is conducted for the second recording layer.

120. The method of claim 117, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens having a positive refracting power

and a negative lens having a negative refracting power and wherein at least one of the positive lens and the negative lens is a displaceable element.

121. The method of claim 120, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens and the negative lens is increased from the case that recording and/or reproducing is conducted for the second recording layer.

122. The method of claim 117, wherein the optical element to change a degree of divergence or a degree of convergence corrects a spherical aberration or an axial chromatic aberration interfering recording and/or reproducing information for the information recording layer to be conducted recording and/or reproducing.

123. The method of claim 122, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens group having a positive

refracting power and a negative lens group having a negative refracting power and satisfies the following formula:

$$vdP > vdN$$

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens group, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens group.

124. The method of claim 123, wherein the vdP and the vdN satisfy the following formulas.

$vdP > 55$

$vdN < 35$

125. The method of claim 122, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and satisfies the following formula:

$$vdP > vdN$$

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens, vdN is an

average of Abbe's number of d-line of all negative lenses including the negative lens.

126. The method of claim 125, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

127. The method of claim 117, wherein the optical element to change a degree of divergence or a degree of convergence changes a distribution of refractive index.

128. The method of claim 109, wherein the converging optical system has an optical element having a aspherical surface.

129. The method of claim 109, wherein the converging optical system has an optical element having a diffractive surface provided with a ring-shaped diffractive structure.

130. The method of claim 109, wherein the converging optical system has an optical element made of a material having a specific gravity of 2.0 or less.

131. The method of claim 130, wherein the converging optical system has an optical element made of a plastic material.

132. The method of claim 130, wherein the converging optical system has an optical element made of a material having a saturation water absorption of 0.5% or less.

133. The method of claim 130, wherein the converging optical system has an optical element having an internal transmission rate of 85% or more at a portion having a thickness of 3 mm for the light flux having a oscillation wavelength of the light source.

134. The method of claim 109, wherein the converging optical system has at least two diaphragms to regulate an image side-numerical aperture for the plurality of information recording layers of the optical information recording medium.

135. The method of claim 134, wherein at least one of the at least two diaphragms is located between a final optical element and the optical information recording medium.

136. The method of claim 109, wherein the converging optical system comprises an optical element formed by etching.

137. A method of recording and/or reproducing information for an optical information recording medium having a plurality of information recording layers with an optical pickup apparatus which comprises a light source to emit a light flux; and a converging optical system to converge the light flux emitted from the light source onto each information recording layer of the plurality of information recording layers, wherein the optical information recording medium comprises a transparent base board on an information recording layer positioned closest to the converging optical system and the transparent base board has a thickness larger than a wavelength of the light source and wherein the converging optical system comprises a final optical element opposite to the optical information recording medium with a gap smaller than the wavelength of the light source; the method comprising a step of:

conducting recording and/or reproducing information for the each information recording layer by converging a light flux having an image side-numerical aperture of 1.0 or more

onto the each information recording layer through the transparent base board.

138. The method of claim 137, wherein the gap is not larger than (1/4) of the wavelength of the light source.

139. The method of claim 137, wherein the optical pickup apparatus further comprises a plurality of converging optical systems as the converging optical system and each of the plurality of converging optical systems is used to conduct recording and/or reproducing information for an information recording layer different from that of others.

140. The method of claim 137, wherein the optical pickup apparatus further comprises a selecting device to select an information recording layer from the plurality of information recording layers, wherein recording and/or reproducing is conducted for the selected information recording layer.

141. The method of claim 140, wherein the converging optical system comprises at least two final optical elements used for conducting recording and/or reproducing for different information recording layers and wherein the selecting device

selects one of the at least two final optical elements and the recording and/or reproducing is conducted for an information recording layer corresponding to the selected final optical element.

142. The method of claim 140, wherein the selecting device changes a wavelength of the light source in accordance with the information recording layer to be conducted recording and/or reproducing.

143. The method of claim 140, wherein at a light source side of the final optical element is provided an optical element to change a degree of divergence or a degree of convergence of an incident light flux on the final optical element in accordance with the information recording layer to be conducted recording and/or reproducing.

144. The method of claim 143, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and wherein at least one of the positive lens group and the negative lens group is a displaceable element.

145. The method of claim 144, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens group and the negative lens group is increased from the case that recording and/or reproducing is conducted for the second recording layer.

146. The method of claim 143, wherein the optical element to change a degree of divergence or a degree of convergence comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and wherein at least one of the positive lens and the negative lens is a displaceable element.

147. The method of claim 146, wherein the optical information recording medium has a first recording layer and a second recording layer provided in that order from a final optical element side, when recording and/or reproducing is conducted for the first recording layer, a gap between the positive lens and the negative lens is increased from the

case that recording and/or reproducing is conducted for the second recording layer.

148. The method of claim 143, wherein the optical element to change a degree of divergence or a degree of convergence corrects a spherical aberration or an axial chromatic aberration interfering recording and/or reproducing information for the information recording layer to be conducted recording and/or reproducing.

149. The method of claim 148, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens group having a positive refracting power and a negative lens group having a negative refracting power and satisfies the following formula:

$$vdP > vdN$$

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens group, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens group.

150. The method of claim 149, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

151. The method of claim 148, wherein the optical element to correct the spherical aberration or the axial chromatic aberration comprises a positive lens having a positive refracting power and a negative lens having a negative refracting power and satisfies the following formula:

vdP > vdN

where vdP is an average of Abbe's number of d-line of all positive lenses including the positive lens, vdN is an average of Abbe's number of d-line of all negative lenses including the negative lens.

152. The method of claim 151, wherein the vdP and the vdN satisfy the following formulas.

vdP > 55

vdN < 35

153. The method of claim 143, wherein the optical element to change a degree of divergence or a degree of convergence changes a distribution of refractive index.

154. The method of claim 137, wherein the converging optical system has an optical element having a aspherical surface.

155. The method of claim 137, wherein the converging optical system has an optical element having a diffractive surface provided with a ring-shaped diffractive structure.

156. The method of claim 137, wherein the converging optical system has an optical element made of a material having a specific gravity of 2.0 or less.

157. The method of claim 156, wherein the converging optical system has an optical element made of a plastic material.

158. The method of claim 156, wherein the converging optical system has an optical element made of a material having a saturation water absorption of 0.5% or less.

159. The method of claim 156, wherein the converging optical system has an optical element having an internal transmission rate of 85% or more at a portion having a thickness of 3 mm for the light flux having a oscillation wavelength of the light source.

160. The method of claim 137, wherein the converging optical system has at least two diaphragms to regulate an image side-numerical aperture for the plurality of information recording layers of the optical information recording medium.

161. The method of claim 160, wherein at least one of the at least two diaphragms is located between a final optical element and the optical information recording medium.

162. The method of claim 137, wherein the converging optical system comprises an optical element formed by etching.